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SCIENCE NEWS-LETTER

The Weekly Summary of Current Science

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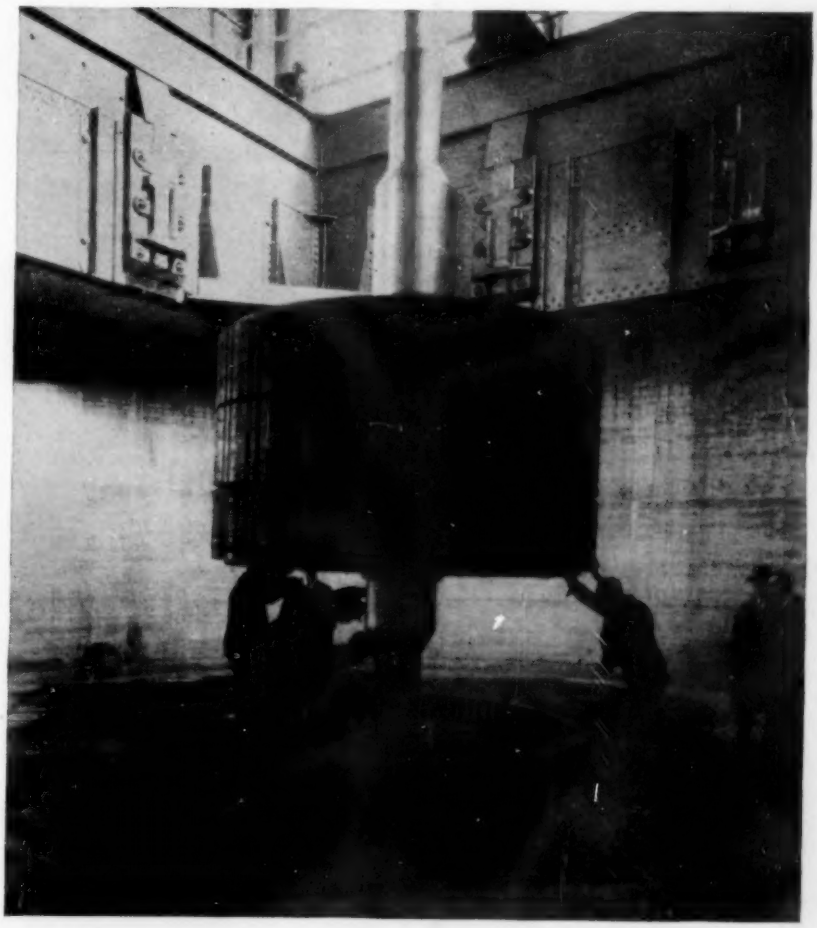

READY TO SMASH

500 Ton Bearing in High-Speed Test Pit

(See page 364)

Vol. XIV No. 401

Iceberg Sea Once Covered Arkansas

Geology

Icebergs similar in form and size to those that imperil the ship lanes of the North Atlantic Ocean were once carried by ocean currents into western Arkansas. This was many millions of years ago, in the Carboniferous period, when the sea covered much of the present area of Arkansas and adjoining states. Just as the icebergs of the North Atlantic are derived from the glaciers of Greenland, the icebergs that visited Arkansas in Carboniferous time were derived from an ancient ice and snow-clad range of mountains lying in Oklahoma and northeastern Texas, south of Ardmore, Okla. From these mountains ocean currents carried the bergs across southeastern Oklahoma into Arkansas.

That such frigid waters once spread into Arkansas is the conclusion of Hugh D. Miser, of the U. S. Geological Survey, from evidence he recently discovered at a locality half a mile east of the village of Boles, Scott County, Ark. There he found fragments of numerous boulders that had been transported by floating ice from the Oklahoma-Texas mountains The boulders were dropped to the bottom of the sea when the rock-laden bergs melted, and they are now found in black shale which was mud at the time the boulders dropped to the ocean floor. The boulders are limestone of many different kinds and some of them are several feet in length. Only portions of the boulders were observed by Mr. Miser because farmers blasted and gathered up much of the limestone many years ago and burnt it into lime.

Although the Boles locality is the first occurrence of ice-transported boulders to be discovered in Arkansas, it is not unlike many such occurrences on the Ouachita mountains of southeastern Oklahoma. It is, however, 30 miles east of the easternmost Oklahoma occurrence, near the village of Stapp on the Kansas City Southern Railroad.

A noteworthy feature of many of these boulders is their enormous size. The huge stones range in size up to blocks measuring 30 feet across. Mr. Miser observed one block measuring 200 feet in length, another with revealed dimensions of 110 by 195 feet, and a third with revealed dimensions measuring 50 by 369 feet.

Science News-Letter, December 15, 1928

Eskimos Catch Colds

Hygiene

The Eskimo never has a cold until he comes in contact with people from the world outside his frozen North. But he has no resistance to colds, and as a result gets one immediately after his first exposure, Dr. Peter Heinbecker and E. I. M. Irvine-Jones of St. Louis reported to the *Journal of Immunology*.

These scientists, who made a trip up the west coast of Greenland, noticed that in some places all the natives were suffering from colds while elsewhere none of them were thus afflicted. In the latter places, the Eskimos all developed colds and coughs in from two to four days after the party's arrival.

Science News-Letter, December 15, 1928

Even the best-designed machinery will smash if run too fast, and usually it is a good thing not to be near when this happens. But engineers can often obtain valuable information by watching what happens when the smash occurs. For that reason big machine factories will actually test full-sized parts by running them overspeed, but such tests are made in thick-walled pits, so that the smash will not do any damage. The cover shows such a test-pit, said to be the largest and safest in the world, at the Schenectady works of the General Electric Company. The workmen are centering a large waterwheel generator rotor on the pit's 500-ton bearing, preparatory to running an overspeed test.

Science News-Letter, December 15, 1928

In This Issue—

City of Brass Restored? p. 365—*Blood* & Drugs, p. 367—Small made *Big*, p. 368—Horses, Cats and Dogs, p. 369—*Pseudo*-Science, p. 370—Four Miles *Down*, p. 371—*Mr. Hoover* Sees Stars, p. 371—Carry in your *pocket*, p. 372—Accommodates *16 Students*, p. 372—Interviews with *Animals*, p. 373—*News*, p. 373—All About *Radio*, p. 374—Seeing in *Color*, p. 375—Live *Rapidly*, p. 377—Dr. *Johnson* Was Right, p. 377—Electric *Gas Meter*, p. 377—Ishmael, p. 377—How to give a really *Merry Christmas*, p. 378.

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All of the resources of Science Service, with its staff of scientific writers and correspondents in centers of research throughout the world, are utilized in the editing of this magazine.

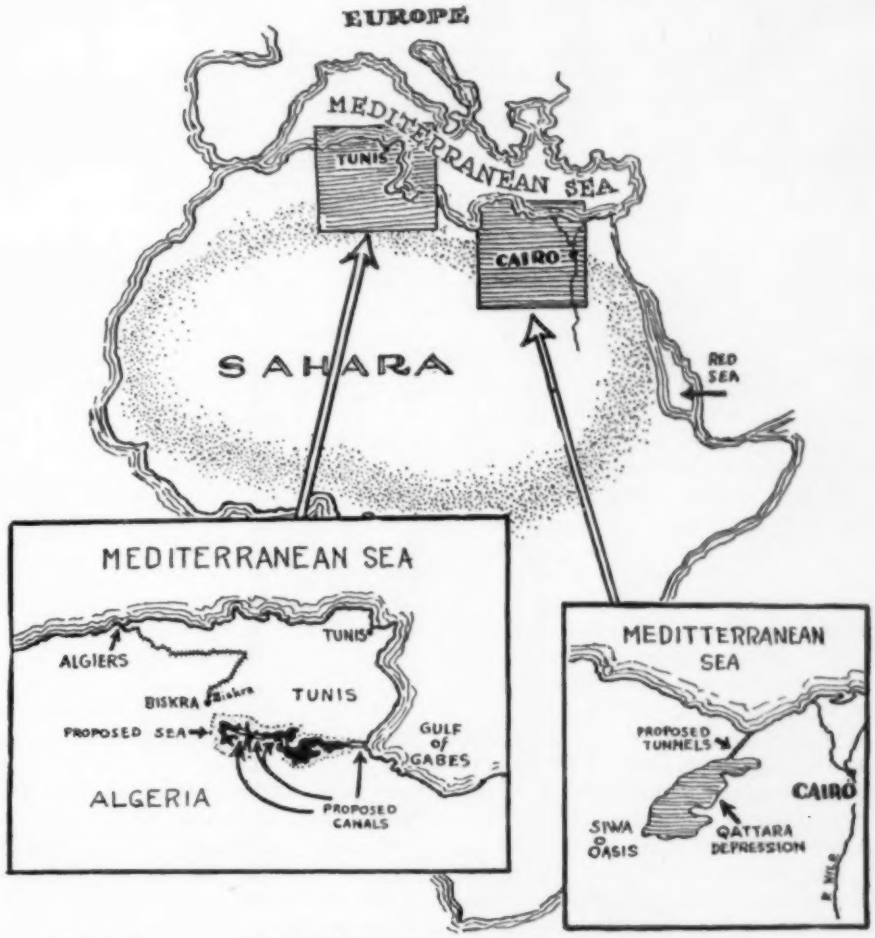
Plans to Restore the City of Brass

Archaeology

By Edwin E. Slosson

The proposal of an American engineer to create an artificial lake in the heart of Tunis draws attention to a desolate spot supposed to have figured largely in legend and romance from the dawn of history and long before. If the reader is not so old as to have forgotten his Arabian Nights he will certainly remember "The City of Brass", how the travelers lost in the desert caught sight of two tall towers of Andalusian brass gleaming like gold in the sun, how they rode around the wall for two days on their camels without finding any gate and how, when finally they surmounted it, they found themselves in a dried-up city. In the market-place the soldiers and salesmen were shriveled to mummies and the stalls were stocked with all sorts of jewels and wares except one thing—food. In the palace under an alabaster cupola on a golden couch lay the sleeping princess but when the vizier attempted to wake her in the usual fairy story way the two bronze statues of slaves swung around and smote him—robot watchmen we should call them. For the wealthy city had been starved out by a seven-year famine such as afflicted the neighboring land of Egypt and there was no Joseph to meet the agricultural crisis with a scheme for the national control of crops and food conservation. So its citizens found that their wealth was valueless, for they could not buy the poorest wheat with their pearls and diamonds though they offered to barter them grain for grain.

But perhaps as you have grown old you have become skeptical. You may doubt the literal truth of the Arabian tale or you may question the verification of its site. Just wait and soon ocular evidence will be presented to you. The German UFA film company has recently taken a feature of "The City of Brass" on the site which it is proposed to flood, west of the Gulf of Gabes. For if you begin to question the correctness of the locale of a motion picture where could you stop? In this case we have the added proof of a Berlin telegram, which we may surmise emanated from the UFA press agent, that Director Wolkoff while shooting the scene found arrow heads and fragments of vases which have been identified by Dr. Paul Borchardt of Munich University as coming from the site of



MAP SHOWING LOCATION of the two proposed inland seas in the Sahara

the famous temple of Poseidon in the lost city of Atlantis 3000 years ago.

If you are so skeptical as to doubt both movie directors and Arabian romancers you may go back to Plato and read for yourself that:

"Here, too, was Poseidon's own temple of a stadium in length and half a stadium in width and of proportionate height, having a sort of barbaric splendor. All the outside of the temple, with the exception of the pinnacles, they covered with silver, and the pinnacles with gold. In the interior of the temple the roof was of ivory, adorned everywhere with gold and silver and brass. In the temple they placed statues of gold: there was the god himself standing in a chariot with six winged horses, and of such size that he touched the roof of the building with his head; around him there were a hundred Nereids riding on dolphins."

But there are skeptics among the Greeks as Critias, who tells the story, adduces documentary evidence. He says he has the original writing from his great-grandfather Dropidas as it was taken down by Solon when it was told him by a priest of Sais, Egypt. The island of Atlantis, he said, was overthrown by an earthquake and sank into the sea nine thousand years before, leaving a shallow place to mark the site of the vanished kingdom.

Locating the lost land of Atlantis has been a favorite guessing game with archaeologists ever since, and is still as popular as ever. About forty years ago an American lawyer, Ignatius Donnelly, took a hand in the game with a book that purported to prove that the Egyptian and Aztec civilization had a common root in a continent once existing in the middle of the Atlantic.

The present vogue is to locate Atlantis in the salt swamps of Tunis. To be sure, Plato says definitely it was an island lying in the ocean beyond the Pillars of Hercules which have been as- (*Turn to next page*)

City of Brass—*Continued*

SHIPS OF THE DESERT

sumed to be the Strait of Gibraltar. It is then rather startling to be told now that Atlantis was in the desert of Sahara west of Gibraltar. But to an enthusiastic archaeologist such discrepancies do not deter. Dr. Borchardt locates here not only Atlantis but also the golden gardens of the Hesperides and the city of Troy. The site of this job lot of legends was, he says, destroyed by an earthquake in 1250 B. C. Professor M. L. Joleaud of the Paris Sorbonne advances a similar theory, although he does not mention the German scholar, and tries to substantiate the idea by evidence from prehistoric rock drawings of North Africa.

The modern novel reader and movie fan have become familiar with this region since Hichens started the fashion of desert romances with "The Garden of Allah" and since the tourist can reach Biskra by rail from Algiers or Tunis. About fifty miles southwest of Biskra starts a series of salt lakes and marshes extending from Algeria westward across Tunis, almost to the Gulf of Gabes. A large part of this area is below the level of the Mediterranean and many engineers in the last sixty years have suggested the possibility of letting in the sea by canals. Colonel Francois Roudaire advocated from 1870 to the time of his death in 1885 a scheme for "flooding the Sahara" at this point, and his project was pronounced feasible by the most famous of French engineers, Count Ferdinand de Lesseps, who constructed the Suez Canal and started the Panama Canal. It was calculated that a cut could be made through the ridge, 13 miles wide and 150 feet high, that separates the Gulf of Gabes from the nearest salt lake, Shat el Jerid, at a cost of $30,000,000 and the labor of five years, and this would open up an artificial lake of 31,000 square miles with an average depth of 78 feet.

The project which is now being urged upon the French Government by the New York engineer, Dwight Braman, provides for cutting three canals, two of fourteen miles and one of four, which, it is estimated, will create an inland lake of some 47,000 square miles, or nearly the size of New York State. This would be deep enough to bring ocean steamships into the heart of the desert and is expected to relieve the aridness of the surrounding region, which is very fertile wherever there is water enough. The sea water, being salt, could not be used for irrigation, but it is hoped that it would raise the water level of the soil moisture and perhaps also increase the rainfall by cooling the atmosphere by evaporation from such a large lake. It is further proposed to irrigate the region north of the new lake by utilizing the winter rainfall on the Aures mountains which now runs off northward into the sea or southward into the desert.

A similar scheme for extending the sea into the Sahara has been recently projected on the British side. Dr. John Ball, Director of the Desert Surveys of Egypt, has found that the Qattara Spring, 130 miles west of Cairo, is in a depression which at one point is 440 feet below the level of the sea. He proposes to run a tunnel through the ridge to the Mediterranean and so not only open an inland sea 200 miles long and 75 miles wide, but also provide water power of 150,000 horsepower perpetually. But it is best to leave the explanation of the advantages to the promoter himself:

"None could fail to appreciate the value to Egypt of being able to obtain this great amount of power from a natural source within her own territory, and at no great distance from a populous district. Instead of depending on foreign fuel for the running of our irrigation and drainage machinery, of our railways, trams and factories, and for illuminating our towns, all this could be done over the whole of the Delta by part of the power obtained from this natural source; the remaining part being utilized for the reclamation of the 2,000,000 acres of waste land in the north of the Delta, which the Ministry of Public Works is supplying with irrigation water and schemes for drainage.

"The use of this power would not be restricted to the above-mentioned purposes, but would also make it possible to create new factories and to make Lower Egypt gradually depend on native industries, the development of which is at present mainly obstructed by the high cost of motive power."

The singular feature of this project for getting power for Egypt from turbines in the Libyan desert is that no provision need be made for running off the water that will pour continuously through the tunnel from the sea above. It is figured that the sun will suck it up from the surface of a lake of such size as fast as it can come in.

The Dead Sea is also one of the sub-sea-level places of the earth and here, too, is the possibility of getting perpetual power by running in water from the Mediterranean as fast as it evaporates. With such artificial water power, the Palestinian desert might indeed be made to blossom as the rose and the new industries of the Zionists would be relieved of their handicap of the lack of coal.

Whether the creation or expansion of such artificial inland lakes in Palestine, Libya or Algeria would materially alleviate the climate of the vicinity and promote agriculture is quite problematical. The water would, of course, be continually getting saltier until, in the course of time, it would be reduced by evaporation to a great salt bed, convenient, indeed, as a source of chemicals, but not good for much else.

It was formerly supposed that a large part of the Sahara Desert was below the level of the sea, so if once the northern dyke were broken through the waters would rush in and form a second Mediterranean, opening up the heart of the Dark Continent to the (*Turn to next page*)

City of Brass—*Continued*

commerce of the world. One of the curiosities of geographical literature is the book entitled "Flooding the Sahara," by Donald MacKenzie, in 1877. He had heard from the Arabs that the "Great Hollow," called by them El Juf, included 60,000 square miles of the Western Sahara was 200 feet below sea level. He urged the British Government to occupy that strip of the Atlantic coast, above Cape Juby, lying between the French possessions and Morocco, and establish here a great seaport at the entrance of an inland sea which would open up the interior of Africa to British trade. The Lord Mayor of London described the scheme in one of the public meetings in these words:

"The distance from the coast to Timbuctoo across the desert is eight hundred miles; and in the event of the sand-barrier, five or six miles in extent, being removed, there would be uninterrupted access to the heart of Africa, and the commerce of Europe and America would be largely developed, besides effecting, what is more important, the abolition of the slave-trade and opening a way to the introduction of Christianity among the African tribes."

When the flooding of the Sahara was first proposed the fear was expressed that the creation of such a great inland sea might divert the Gulf Stream into the Straits of Gibraltar and so leave the British Isles as cold as Labrador, which is in the same latitude. But this alarm was allayed and the scheme collapsed when a better knowledge of land levels showed that most of the Sahara was over six hundred feet above sea level, much of it above 1,600, and it would take a lot of pumping to keep it wet.

Readers who know their Ibsen will remember that it was one of the get-rich-quick schemes of that prince of promoters, Peer Gynt, when he found himself cast away on the sandy shore of North Africa:

The sea's to the west; it lies piled up behind me,
Dammed out from the desert by a sloping ridge.
Dammed out? Then I could——? The ridge is narrow.
Dammed out? It wants but a gap, a canal—
Like a flood of life would the waters rush
In through the channel, and fill the desert!
Soon would the whole of yon red-hot grave
Spread forth, a breezy and rippling sea.
The oases would rise in the midst, like islands;
Atlas would tower in green cliffs on the north;
Sailing-ships would, like stray birds on the wing,
Skim to the south, on the caravans' track.
Life-giving breezes would scatter the choking
Vapours, and dew would distil from the clouds.
People would build themselves town on town,
And grass would grow green round the swaying palm-trees.
The southland, behind the Sahara's wall,
Would make a new seaboard for civilization.
Steam would set Timbuctoo's factories spinning;
Bornu would be colonized apace;
The naturalist would pass safely through Habes
In his railway-car to the Upper Nile.
In the midst of my sea, on a fat oasis,
I will replant the Norwegian race;
The Dalesman's blood is next door to royal!
Arabic crossing will do the rest.
Skirting a bay, on a shelving stand,
I'll build the chief city, Peeropolis.
The world is decrepit! Now comes the turn
Of Gyntiania, my virgin land!

Here the poet has anticipated the engineer, for "Peer Gynt" was written in 1867.

But geological exploration has exploded the old idea that the desert was merely the dried bed of an ancient sea which might be again filled if only the barrier were once broken, though the projects for filling the known depressions near the north coast seem feasible.

However fanciful may be the legends of the Atlantis and the City of Brass, it is certain that the region hereabouts, now largely given over to the sands of the Sahara, was once the seat of a high civilization. To the east of the Gulf of Gabes, which it is proposed to make the entrance of the artificial lake, lies Tripoli, the "Land of the Three Cities," as the Latin name implies, which once rivaled Egypt in fertility and wealth, while to the north lies Carthage, which formerly disputed with Rome the supremacy of the world. The Phoenician city is estimated to have had a population of from seven hundred thousand to a million before its destruction by Roman power. After its conquest the Romans built many cities along the coast and to a considerable distance inland. One of them, Tacape, stood on the site of the present town of Gabes, and the Arabs have used the pillars and carved stones from its ruins for building material. Gabes, the prospective port, (*Turn to next page*)

Blood Influences Drug

Physiology

The effect of a dose of medicine depends not merely on the chemical makeup of the medicine itself but on the chemical state of the blood in our bodies when we take it. This is indicated by the experiments of Dr. William Salant, of the University of Georgia Medical School, performed partly at the Cold Spring Harbor Biological Station on Long Island.

The blood of all warm-blooded animals is normally slightly alkaline. When Dr. Salant injected doses of the drug ergotamin into experimental animals whose blood alkalinity had been artificially reduced, a marked depression in their blood pressure resulted. It was possible to restore the pressure to normal or even to increase it beyond that point, simply by controlling the degree of alkalinity of the blood.

The effects of a drug depend not only on the alkalinity of the blood but also on the particular balance of certain elements. Dr. Salant has found that the concentrations of calcium and potassium in the blood are of especial significance in this respect. If the blood is lacking in calcium, adrenalin, a powerful stimulant and energy-releasing secretion, can not produce results. Even a considerable reduction in the calcium content inhibits the action of adrenalin, unless the potassium present is correspondingly reduced.

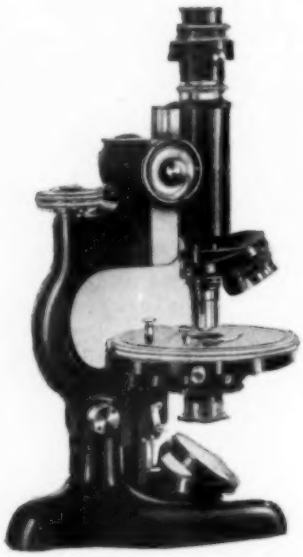
If much potassium is present, the poisonous effects of nicotin are greatly increased; and in the presence of an excess of potassium the usually stimulating adrenalin reverses its behavior and becomes a depressant.

The toxicity of mercury is greatly increased by reducing the calcium concentration in the blood. But if the calcium content is increased the resistance to this poison, and also to arsenic, is correspondingly increased. This point may eventually become one of importance in medical practice, because both mercury and arsenic, though poisonous, are widely used in medicine, especially in the treatment of syphilis. The diet of the patient, insofar as it affects the potassium and calcium content of his body fluids, becomes a matter of concern in the light of Dr. Salant's researches. It is recognized that the average American diet is very low in calcium.

Science News-Letter, December 15, 1928

Germany has 10,000 miles of air routes.

The Chemist's Right-Hand Man



The various types of work peculiar to a chemist demand a microscope possessing all of the characteristics necessary to perform such work. The chemist will find the New B. & L. Chemical Microscope able to answer all of his requirements.

The base, pillar and arm have been redesigned to give more room for the manipulation of the specimen and instruments.

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City of Brass—*Cont'd*

has now 20,000 population, supported mainly by the dates and olives grown in the rich oasis which is watered by a stream only twenty miles long.

Inland from Gabes and separated by a low ridge that can be easily cut by a canal is "The Lake of the Palm Trees," or Shat el Jerid, as the Arabs call it, merely a mud flat encrusted with salt and gypsum most of the year, but sometimes in winter wet up by the rains or covered with a few feet of water. Beyond lie similar salt lakes, or "shats," which it is planned to connect by canals since their beds are below the sea level.

Why the country once so flourishing should now be so desolate is a disputed question. Some lay it to the increasing aridity of the climate. Others say it is due to volcanic disturbance of level. Others ascribe it to "the blight of Islam." The land itself bears evidence that it was once well watered, for it is furrowed by deep valleys and dried-up watercourses. That the region is volcanic is shown by the hot springs of salt and fresh water in the adjacent hills.

The next and more important question is how the land can be restored to prosperity, and that is why the French colonial authorities lend an eager ear to such proposals as those of Colonel Roudaire and Mr. Braman.

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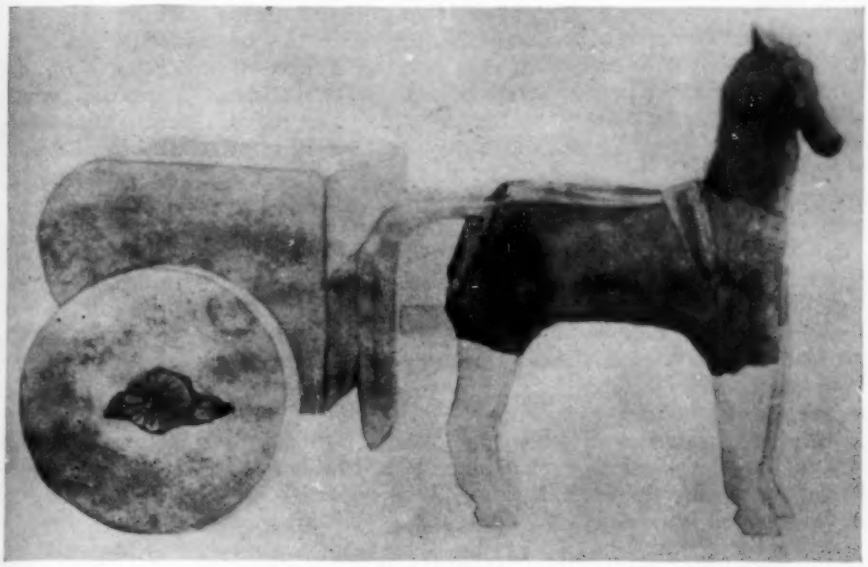
Canaanite Tower Unearthed at Beth-Shan

Archæology



IN MINIATURE SIZE, the iron war chariots of the Canaanites are not alarming, but the real chariots struck terror to the hearts of the Israelites

How Egyptian and Canaanite soldiers fought and worshipped within the walls of Beth-shan in the valley of the Jordan, 3,300 years ago, is shown by a report on the newest finds made by the University of Pennsylvania Museum's expedition to Palestine by the director, Alan Rowe. This is the seventh season that the expedition has excavated at this famous Biblical city, now known as Beisan.

A great fort-tower, with thick walls of brick, is one of the important finds from the period before the coming of the Children of Israel, when Palestine was a conquered province of Egypt and was occupied by the Canaanites. This fort-tower must have served as a last refuge for troops in time of siege, Mr. Rowe concludes. Adjoining it are the foundations of a building which he believes may well have been the residence of the Egyptian commandant of the fort in the time of Rameses II., the Pharaoh of the Oppression.

"Egyptian scribes and craftsmen must also have been quartered in the fort, Mr. Rowe reports, "for we have now actually found the handiwork of one of these very scribes on a potsherd which was in the corridor west of the commandant's residence."

The inscription on the fragment is part of a religious text translated as: "The fiend in the house of the ruddy beings." The fiend is the god Set and the ruddy beings are his associates, which included the hippopotamus, pig, crocodile and serpent. The inscription is of particular importance, since it is the first evidence at Beisan of the hieratic writing used by the Egyptians instead of hieroglyphics for ordinary business documents.

Among the objects discovered in the fort-tower were a small figurine of a king wearing a false beard, a small jar in the form of a squatting man, and fragments of a pottery model of a two-horsed war chariot, representing the horses, the poles and the yokes.

"Discovery of the chariot model recalls the Biblical passage in the sixteenth verse of the seventeenth chapter of Joshua," Mr. Rowe states, "in which it is written, 'And the Children of Joseph said, The hill is not enough for us; and all the Canaanites that dwell in the land of the valley have chariots of iron, both they who are of Beth-shean and her towns, and they who are of the valley of Jezreel.'"

In the courtyard of the residence was discovered an enormous cylinder-shaped silo built of bricks, which has a present content of 9,270 modern gallons.

A temple dating back to Thotmes III, who reigned about 500 B. C., has been excavated, revealing the plans of the structure, and also a great circular fireplace which must have been used for roasting the sacrificial animals, and a Canaanite well, associated with the temple and pronounced the oldest well of its kind discovered in Palestine.

Science News-Letter, December 15, 1928

A GOOD LUCK CAT, more soberly described as a cat amulet of jasper, found in the ruins of the fort-tower

NOT AN AIREDALE with a bone, but a little bronze dog of Beth-shan, about 1300 B. C.

When yellow jackets sting they sometimes leave the stinger in the puncture and sometimes do not.

The Hottentots of Africa got their name because their queer, clicking language suggested this sort of sound.

Umbrella ants are so called because they carry to their nests scraps of leaves over their heads, umbrella-fashion.

That a feudal system similar to that of medieval Europe existed in ancient Babylonia is shown by a clay tablet recently translated.

Ancient forest practices followed the belief that when the moon waned the sap in a tree flowed downward and trees should be cut at that time when the wood was drier.

On Some Astronomical Paradoxes

Astronomy

Though these words were published just half a century ago the paradoxer, in astronomy as in other sciences, is still with us, but unfortunately we have no De Morgan or Proctor either, to keep them in their places.

RICHARD A. PROCTOR, in *Myths and Marvels of Astronomy* (Chatto and Windus. 1878):

For many years the late Professor De Morgan contributed to the columns of the *Athenæum* a series of papers in which he dealt with the strange treatises in which the earth is flattened, the circle squared, the angle divided into three, the cube doubled (the famous problem which the Delphic oracle set astronomers), and the whole of modern astronomy shown to be a delusion and a snare. He treated these works in a quaint fashion: not unkindly, for his was a kindly nature; not even earnestly, though he was thoroughly in earnest; yet in such sort as to rouse the indignation of the unfortunate paradoxists. He was abused roundly for what he said, but much more roundly when he declined further controversy. Paradoxists of the ignorant sort (for it must be remembered that not all are ignorant) are, indeed, well practised in abuse, and have long learned to call mathematicians and astronomers cheats and charlatans. They freely used their vocabulary for the benefit of De Morgan, whom they denounced as a scurrilous scribbler, a defamatory, dishonest, abusive, ungentlemanly, and libellous trickster.

He bore this shower of abuse with exceeding patience and good nature. He had not been wholly unprepared for it, in fact; and, as he had a purpose in dealing with the paradoxists, he was satisfied to continue that quiet analysis of their work which so roused their indignation. He found in them a curious subject of study; and he found an equally curious subject of study in their disciples. The simpler—not to say more foolish—paradoxists, whose wonderful discoveries are merely amazing misapprehensions, were even more interesting to De Morgan than the craftier sort who make a living, or try to make a living, out of their pretended theories. Indeed, these last he treated, as they deserved, with a scathing satire quite different from his humorous and not ungenial comments on the wonderful theories of the honest paradoxists.

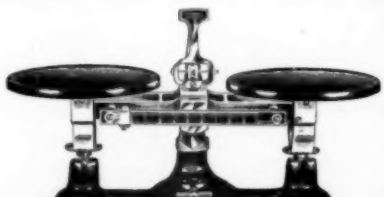
There is one special use to which the study of paradox-literature may be applied, which—so far as I know—has not hitherto been much attended to. It may be questioned whether half the strange notions into which paradoxists fall must not be ascribed to the vagueness of too many of our scientific treatises. A half-understood explanation, or a carelessly worded account of some natural phenomenon, leads the paradoxist, whose nature is compounded of conceit and simplicity, to originate a theory of his own on the subject. Once such a theory has been devised, it takes complete possession of the paradoxist's mind. All the facts of which he thenceforward hears which bear in the least on his favourite craze, appear to give evidence in its favour, even though in reality they are most obviously opposed to it. He learns to look upon himself as an unappreciated Newton, and to see the bitterest malevolence in those who venture to question his preposterous notions. He is fortunate if he do not suffer his theories to withdraw him from his means of earning a livelihood, or if he do not waste his substance in propounding and defending them.

* * * * * * *

It has often seemed to me that a large part of the mischief—for let it be remembered that the published errors of the paradoxist are indicative of much unpublished misapprehension—arises from the undeserved contempt with which our books of astronomy too often treat the labours of Ptolemy, Tycho Brahe, and others who advocated erroneous theories. If the simple truth were told, that the theory of Ptolemy was a masterpiece of ingenuity and that it was worked out by his followers in a way which merits the highest possible praise, while the theory of Tycho Brahe was placed in reality on a sounder basis than that of Copernicus, and accounted as well and as simply for observed appearances, the student would begin to realise the noble nature of the problem which those great astronomers dealt with. And again, if stress were laid upon the fact that Tycho Brahe devoted years upon years of his life to secure such observations of the planets as might settle the questions at issue, the student would learn something of the spirit in which the true lover of science proceeds.

It seems to me, also, that far too little is said about the kind of work by which Kepler and Newton finally established the accepted theories. There is a strange charm in the history of those twenty years of Kepler's life during which he was analysing the observations made by Tycho Brahe. Surrounded with domestic trials and anxieties, which might well have claimed his whole attention, tried grievously by ill-health and bodily anguish, he laboured all those years upon erroneous theories. The very worst of these had infinitely more evidence in its favour than the best which the paradoxists have brought forth. There was not one of those theories which nine out of ten of his scientific contemporaries would not have accepted ungrudgingly. Yet he wrought these theories one after another to their own disproof. *Nineteen* of them he tried and rejected—the twentieth was the true theory of the solar system. Perhaps nothing in the whole history of astronomy affords a nobler lesson to the student of science—unless, indeed, it be the calm philosophy with which Newton for eighteen years suffered the theory of the universe to remain in abeyance, because faulty measurements of the earth prevented his calculations from agreeing with observed facts.

Science News-Letter, December 15, 1928



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Submarine Shows Sub-Ocean Pressures

Geophysics

Pressures along the floor of the Atlantic Ocean force Porto Rico up and the ocean bottom north of it down to form the great Nares deep. This is indicated by observations of the intensity of gravity in this region just made from the submarine S-21. Dr. F. A. Vening-Meinesz, of the Netherlands Geodetic Commission, who was in charge of the work, told about the investigations at a meeting of the Washington Academy of Sciences, the U. S. Navy Department and the Carnegie Institution of Washington. Dr. F. E. Wright, who, with E. B. Colline, of the Navy Department, accompanied Dr. Vening-Meinesz, spoke about the results and described some of the details of the trip. It lasted about two months and covered also the Gulf of Mexico and the Caribbean Sea.

Gravity measurements are made for two purposes, Dr. Vening Meinesz explained. One is to ascertain the exact shape of the earth, while the other is to study the behavior of the crust of the earth.

The only way of measuring the intensity of gravity with the required accuracy is by timing the swings of a pendulum. A pair of scales would not show its variation because both sides of the scales would be affected equally. A pendulum, however, vibrates more rapidly the greater the gravitational pull. Previously, it has only been possible to make such gravity measurements on land, as the rocking of a ship interfered with the pendulum. Dr. Vening-Meinesz invented a method of using two pendulums. While both are affected by the sway of the ship, their motion may be combined in such a way that the result is the same as of one steady pendulum. As, however, the method can only be applied if the ship's motion does not exceed a certain limit, he made his observations from a submerged submarine, where the motion of the waves has very small effect. Two trips in a Dutch submarine from Holland to Java, in opposite directions, showed the practicability of the device. As a result of the cooperation of the U. S. Navy with the Carnegie Institution, he was extended the use of the American submarine S-21, for gravity observations in the Gulf of Mexico and Caribbean Sea.

Submarine measurements have some advantages over land observations, he said. One is that there are no local irregularities of mass to cause disturbances, as there is nothing in the immediate vicinity of the submarine but water and air. Also, erosion, by which atmospheric conditions, such as wind and rain, rapidly shift land masses, is entirely absent on the ocean bottom.

In general, the investigations confirm the theory of isostasy, by which the earth's crust is supposed to consist of masses of various densities floating on a more or less fluid mass below. However, they found a departure of equilibrium in certain regions, which reveal stresses in the ocean bottom or in the subcrustal layers. One of these regions is the central part of the Gulf of Mexico. Besides that, two great ocean deeps were studied. One is the Bartlett deep, about 22,500 feet, southeast of Cuba and between that island and Jamaica. Here they had the busiest time of their trip, for in 18 hours they made 5 separate dives and observations. Altogether 49 gravity observations, each requiring a separate dive, were made. The Bartlett deep, however, rather unexpectedly showed no great stresses. (*Turn to next page*).

Strange Stars Seen by Hoover

Astronomy

Strange stars and constellations, unknown to those of us who live in countries north of the tropics, have come into view in the evenings for President-elect Hoover and his party in South America. The sun and moon seem to move across the sky backwards, and Summer is just beginning in the countries visited.

All these things are results of the fact that the earth is a globe. The stars are distributed all around the earth as on a sphere. From any part of the earth's surface, only half of this sphere can be seen at a time. On account of this, from our position half way between the Equator and the North Pole, there is a circle of stars around the southern heavenly pole that never rises. For us they are entirely isvisible. As one travels south, more and more of them come into view. At the Equator, all of the stars are visible at some time of the year. South of the Equator, the pole-star, and such familiar constellations as Cassiopeia, the Great Bear and Cepheus, remain continually below the northern horizon. The unfamiliar groups around the South Pole take their places.

When Mr. Hoover was in Valparaiso he was as far south of the Equator as Los Angeles, Birmingham or Charleston are north of it. The star Fomalhaut, in the constellation of Piscis Australis, the southern fish, which we see now low in the southern sky, about 7 p. m., is overhead in the early evening hours. Around it are such unfamiliar groups as Pavo, the peacock; Grus, the goose; Phoenix and Indus, the Indian. Low in the southwest may be seen Crux, the famous "Southern Cross". Near it he can see alpha Centauri, nearest of all the known stars to the earth. The huge constellation of Argo, the ship, will not be visible at this time of year in the evening sky, but he can see it if he stays up until early morning hours.

Some of these southern constellations that the members of the Hoover party will see have such queer names as Antlia Pneumatica, the air pump; Horologium, the clock; Microscopium, the microscope, and Norma, the rule. These names, so different from the mythological appellations of the northern groups, date from the eighteenth century, when astronomers began their first extensive observations of the southern stars. Finding a lot of empty spaces in the skies, they proceeded to fill them with familiar pieces of scientific apparatus of the period.

As Mr. Hoover looks to the southeast in the evening he will see the two Magellanic clouds, appearing as two detached pieces of the Milky Way. These are really systems of stars outside of our own, but are our closest neighbors in space.

When the sun moves southward, and lower in our skies, it brings winter for us. At the same time it is rising higher in southern countries. and bringing summer. Our winter solstice, on December 21, at 9:04 p. m., Eastern (*Turn to next page*)

Submarine Expedition—*Continued*

North of Porto Rico they studied the Nares deep, which showed great stresses at work. In the deep itself, the sides of which slope as much as 40 degrees in some cases, there was a deficiency of gravity, while to the south there was an excess. Dr. Vening-Meinesz thinks that this indicates that there is a horizontal pressure in a north and south direction in the ocean bottom in this region. This pressure causes a buckling, pushing Porto Rico up, and the deep down. The observations show that this pressure extends to even as far as East Cuba, i. e., much farther than the configuration of the ocean floor indicates.

From their studies in the Gulf of Mexico, off the delta of the Mississippi, they found no evidence that the large masses which the river is continually depositing on the ocean bottom disturb the equilibrium. Apparently as fast as this deposit is laid down, the adjustments take place.

When the computation of the results is complete some new light may also be shed on Wegener's theory that north and south America and Europe and Africa were originally joined, but that the western continent is floating away from the eastern. In his previous observations Dr. Vening-Meinesz found an excess of gravity off the Pacific shore of Central America, which might furnish an indication that the Americas were pushing westwards. This would be in accord with Wegener's ideas. Now during this expedition, observations were made off the Atlantic coast. If these prove that there is a deficiency of gravity in this region, it would be in accord with this theory, for it would show a pull instead of a pressure on the bottom. If it proves that gravity is in excess here also, however, the theory will get no confirmation.

Dr. Vening-Meinesz expressed his thanks to the U. S. Navy authorities and the Carnegie Institution for making this scientific investigation possible. He acknowledged the wholehearted cooperation of Lieutenant Fisher in command of the S-21, of the commandant of the expedition, Lieutenant Nash, and of the officers and crew of the submarine.

Science News-Letter, December 15, 1928

Strange Stars—*Cont'd*

Standard Time, marks the beginning of summer in South America, South Africa and Australia. As Valparaiso is south of the tropic of Capricorn, which is the southern limit of the sun's path, the sun is always in the north. As it travels from east to west, as usual, this means that it travels across the sky from right to left, instead of from left to right, as we see it from the United States. The same thing is true of the moon. It, too, will seem to cross the sky in reverse.

Science News-Letter, December 15, 1928

A new factory in Switzerland will manufacture glucose from sawdust.

Twenty per cent. of the automobile headlights in use are too bright, government tests indicate.

There are about 18 distinct varieties of cheese, but there are more than 400 local names for the different kinds.

A stamp vending machine tried out by the Los Angeles post office not only dispenses one and two cent stamps but returns correct change to the customer.

Christmas Gifts

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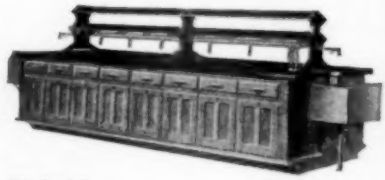

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FIRST GLANCES AT NEW BOOKS

WILD ANIMAL INTERVIEWS—William T. Hornaday—*Scribner's* ($2.50). Here are some Just So stories that really *are* so. Dr. Hornaday, you know, took care of the New York Zoo for years and years and years, and he can talk to animals, and understand them when they answer him. Their opinions of their brother, Man, aren't always nice (why should they be, considering the way he treats them?) but they are always interesting, and Dr. Hornaday, who is a great-grandnephew of St. Francis, makes a good apologist for our species to the rest of the animal kingdom. For the sake of skeptical children who have grown up and got too smart, be it added that these animals are real, live ones, and so are the people mentioned, and the stories are true, and really happened.

Natural History
Science News-Letter, December 15, 1928

KEEPING MENTALLY FIT—Joseph Jastrow—*Greenberg* ($3.50). A collection of brief articles, each one driving home its psychological principle. "Are you a bore?" demands one chapter heading. "Are you social or mechanical?" queries another. "What is absent-mindedness?" These and many other questions are answered with a never-ending store of illustrative and anecdotal material and a clear-cut summing up of the point. The author who presents his science so readably was for thirty years professor of psychology at the University of Wisconsin.

Psychology
Science News-Letter, December 15, 1928

DESERT DRUMS—Leo Crane—*Little, Brown* ($5). The subtitle is "The Pueblo Indians of New Mexico, 1540-1928", and the author has been an Indian agent in the Southwest for many years. His experiences with Pueblo customs, beliefs, and political problems are recounted in informal style and with a leisurely thoroughness. Incidents and discussions showing the relationships of the government with the Indians are of particular interest.

Ethnology
Science News-Letter, December 15, 1928

PRAIRIE BIRDS—B. J. Hales—*Macmillan (Canada)*. ($3). A compact but comprehensive *vade-mecum* for the bird observer in the great middle country; well illustrated.

Ornithology
Science News-Letter, December 15, 1928

THE BOOK OF EARTHS—Edna Kenton—*Morrow* ($6). A comprehensive outline of cosmographical theories from the earliest times to the present. The author has performed a most creditable piece of work, though some modern theories are given which could hardly be classified as sound science. Evidently the delving into so many theories has made her skeptical of all, even those definitely established by modern research. for she concludes with the statement that "science today is committed to nothing but 'guesses' on the still unknown figure of the earth" and compares modern goedesists with "that first man, whoever and wherever and whenever he was, who said, 'Perhaps it is like this,' and set down his crude lines of an island in the sea." But even so, the book constitutes a valuable source of information.

Cosmogony
Science News-Letter, December 15, 1928

THE LIFE OF SPACE—Maurice Maeterlinck, Translated by Bernard Miall—*Dodd, Mead* ($2.50). Five essays on the fourth and higher dimensions. The famous dramatist seems to have been greatly influenced by P. D. Ouspensky's "Tertium Organum" and J. W. Dunnes' "Experiment with Time." The first, and longest, essay, on the fourth dimension, is largely devoted to an exposition of Ouspensky, while the second, on the cultivation of dreams, does much the same thing for Dunnes' book. Maeterlinck foresees a time when man will develop such a super-intelligence that he will be able to perceive the fourth dimension, and use his knowledge accordingly.

Metaphysics
Science News-Letter, December 15, 1928

THE GREAT PHYSICISTS—Ivor B. Hart—*Methuen* (3/6). A broad and popular survey of the chief steps in the development of physical science from Thales to Lord Kelvin by a well-known historian of science. Though small in size, and low in price (though American dealers may charge considerably more for it than the equivalent of the English price plus duty) it will be a worthy addition to any scientific library. And when one reads it he will look forward to the next volumes in the series of "The Great Scientists", which it inaugurates.

Physics
Science News-Letter, December 15, 1928

THE BOYS' LIFE OF THE WRIGHT BROTHERS—Mitchell V. Charnley—*Harpers* ($2). This story of the first men to fly is of especial interest because the twenty-fifth anniversary of their first flight is now being observed. The story of events at this first flight, and how it was reported to the world, as well as later flights, and how the world was reticent about believing their success, is told in great detail.

Aviation
Science News-Letter, December 15, 1928

THE BOYS' BOOK OF REMARKABLE MACHINERY—Ellison Hawks—*Dodd, Mead* ($2.50). A new book by this prolific English writer on popular science dealing with the fascinating subject of all kinds of machinery. He tells about the machines and their developments in a manner that anyone can understand, even when he is explaining such an unusual and remarkable piece of mechanism as the torque converter, which may revolutionize automotive design.

Engineering
Science News-Letter, December 15, 1928

WHAT ENGINEERS DO—Walter D. Binger—*Norton* ($2.75). The story of civil engineering, how bridges are thrown across chasms and streams, how skyscrapers are built, why concrete is as strong as it is, and what the surveyor does with his transit, all told in a vivid and interesting manner. Though written primarily for boys and girls, there is no "writing down" and so it will be especially interesting to them, and also to the adult who wants to know about the work of the civil engineer.

Engineering
Science News-Letter, December 15, 1928

WHY NEWS IS NEWS—Charles R. Corbin — *Ronald* ($2.75). What makes a news story "hot"? In this book the managing editor of the Toledo *Blade* (who should know a good news story as well as any one) summarizes the elements of news, and illustrates his point by numerous quotations from newspapers. Incidentally, three Science Service stories are quoted as good examples of how science can be treated as news. Anyone who wants to write articles that will be used in newspapers, whether for pay, or in order to secure publicity for some cause in which he is interested, should study and ponder over this book.

Journalism
Science News-Letter, December 15, 1928

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First Glances at New Books—*Continued*

ANNUAL SURVEY OF AMERICAN CHEMISTRY — Clarence J. West — *Chemical Catalog* ($3). As in the two previous issues of this now standard annual a group of chemists, each an authority in his particular field, reviews the progress made during the past year. This volume covers the period from July 1, 1927, to July 1, 1928, and will be a welcome addition to the library of anyone who is interested in what is being done in any branch of chemistry.

Chemistry
Science News-Letter, December 15, 1928

MAN A MACHINE—Joseph Needham—*W. W. Norton and Co.* ($1). Modern physicians often refer to the human body as a machine, but the mechanistic theory has been debated for many centuries. Professor Needham reviews the chief arguments and presents a few of his own which add to the age-old subject a decidedly modern note.

Philosophy
Science News-Letter, December 15, 1928

THE POLAR REGIONS IN THE TWENTIETH CENTURY—A. W. Greely —*Little, Brown* ($4). It was in the years 1881-1884 that General Greely made his famous expedition to the Arctic, after which he wrote a book on polar exploration up to that time. In this book, nearly fifty years later, he summarizes more than 80,000 pages of original narratives of the expeditions of Peary, Amundsen, Shackleton, Byrd, Macmillan, etc.

Exploration
Science News-Letter, December 15, 1928

THE CONQUEST OF LIFE — Serge Voronoff — *Brentano's* ($3.50). In this book Dr. Voronoff describes his gland graft experiments and his results in simple language for the layman. While the subject is one of great interest to every human being, this work must be regarded as still in the experimental stage. Dr. Voronoff's results are questioned by the majority of scientists, including medical men. The deputation that visited his experimental farms in Africa was not convinced that Dr. Voronoff had proved his theories.

Biology
Science News-Letter, December 15, 1928

THE SYMMETRICAL OPTICAL SYSTEM—G. C. Steward—*Macmillan* An outline of the theory of the symmetrical optical system, both from the purely geometrical and also from the physical point of view.

Optics
Science News-Letter, December 15, 1928

THE ELECTRIC WORLD: THE RISE OF RADIO—Paul Schubert—*Macmillan* ($2.50). Here is a book on radio that is quite different in character from most of those that have so far appeared—it tells of the development of radio in all its scientific phases from the early experiments of Hertz to modern broadcasting. But it does more than that—it tells also of the economic, the business and the political phases of the art. It tells how they have all interacted in making radio communication what it is today. Truly a book for all interested in radio, whether that interest is merely that of the dial-twister, or occasional sender of a radiogram, or of the radio engineer.

Radio
Science News-Letter, December 15, 1928

THE OUTLINE OF RADIO—John V. L. Hogan—*Little, Brown* ($2). A complete account of radio and how it works. As the book has passed through two previous editions, both of which were well received, and this one has been brought fully up to date, it seems certain that it will have a wide distribution.

Radio
Science News-Letter, December 15, 1928

THE BOOK OF ELECTRICITY—Bertha Morris Parker—*Houghton, Mifflin* ($1.50). A book for children from 10 to 14 years of age. It contains not only a simple explanation of familiar electrical phenomena, but also accounts of what famous workers in the field have done and directions for simple experiments. Naturally, all of these are perfectly safe for the child.

Electricity
Science News-Letter, December 15, 1928

THE GROWTH OF MANUFACTURES —Edmund E. Day and Woodlief Thomas—*Government Printing Office* ($1.35). A study issued by the Bureau of the Census of indexes of increase in the volume of manufactured products.

Economics
Science News-Letter, December 15, 1928

INTRODUCTION TO WORLD GEOGRAPHY—Philip A. Knowlton—*Macmillan* ($1.32). A first text-book in geography for elementary schools. It is simply and clearly written, while the numerous illustrations, many in color, will make it attractive to the children.

Geography
Science News-Letter, December 15, 1928

CLASSICS OF SCIENCE: Young on Color Vision

Physics

Make a color top and try the effects of combining the spectral colors in different ways. Also, hold a prism close to your eyes and see whether you can see the dark "Fraunhofer lines" crossing the bright solar spectrum.

A COURSE OF LECTURES ON NATURAL PHILOSOPHY AND THE MECHANICAL ARTS, by Thomas Young, M. D., London, 1907.

Colours in White Light

The separation of colours by refraction is one of the most striking of all optical phenomena. It was discovered by Newton that white light is a compound of rays of different kinds, mixed in a certain proportion, that these rays differ in colour and in refrangibility, that they constitute a series, which proceeds by gradual changes from red to violet, and that those substances which appear coloured when placed in white light, derive their colours only from the property reflecting some kind of rays most abundantly, and of transmitting or extinguishing the rest. Dr. Herschel has added to this series rays of heat less refrangible than the red, and Ritter and Dr. Wollaston have discovered, beyond the violet, other still more refrangible rays, which blacken the salts of silver.

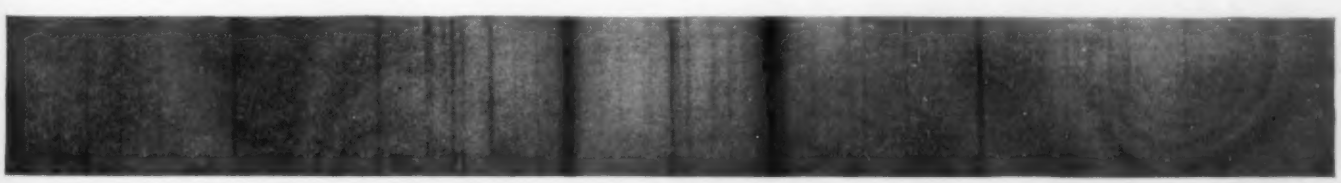
It has generally been supposed, since the time of Newton, that when the rays of light are separated as completely as possible by means of refraction, they exhibit seven varieties of colour, related to each other with respect to the extent that they occupy, in ratios nearly analogous to those of the ascending scale of the minor mode in music. The observations were, however, imperfect, and the analogy was wholly imaginary. Dr. Wollaston has determined the division of the coloured image or spectrum, in a much more accurate manner than had been done before: by looking through a prism, at a narrow line of light, he produces a more effectual separation of the colours, than can be obtained by the common method of throwing the sun's image on a wall. The spectrum formed in this manner consists of four colours only, red, green, blue, and violet, which occupy spaces in the proportion of 16, 23, 36, and 25 respectively, making together 100 for the whole length; the red being nearly one-sixth, the green and the violet each about one-fourth, and the blue more than one-third of the length. The colours differ scarcely at all in quality within their respective limits, but they vary in brightness; the greatest intensity of light being in that part of the green which is nearest to the red. A narrow line of yellow is generally visible at the limit of the red and green, but its breadth scarcely exceeds that of the aperture by which the light is admitted, and Dr. Wollaston attributes it to the mixture of the red with the green light. There are also several dark lines crossing the spectrum within the blue portion and its neighbourhood, in which the continuity of the light seems to be interrupted. This distribution of the spectrum Dr. Wollaston has found to be the same, whatever refracting substance may have been employed for its formation; and he attributes the difference which has sometimes been observed in the proportions, to accidental variations of the obliquity of the rays. The angular extent of the spectrum formed by a prism of crown glass is one-twenty-seventh of the deviation of the red rays; by a prism of flint glass, one-nineteenth.

In light produced by the combustion of terrestrial substances, the spectrum is sometimes still more interrupted; thus, the bluish light of the lower part of a flame of a candle is separated by refraction into five parcels of various colours; the light of burning spirits, which appears perfectly blue, is chiefly composed of green and violet rays; and the light of a candle into which salt is thrown abounds with a pure yellow, inclining to green, but not separable by refraction. The electrical spark furnished also a light which is differently divided in different circumstances.

If the breadth of the aperature viewed through a prism is somewhat increased, the space occupied by each variety of light in the spectrum is augmented in the same proportion, and each portion encroaches on the neighbouring colours, and is mixed with them; so that the red is succeeded by orange, yellow, and yellowish green, and the blue is mixed on the one side with the green, and on the other with the violet; and it is in this state that the prismatic spectrum is commonly exhibited.

When the beam of light is so much enlarged as to exceed the angular magnitude of the spectrum, it retains its whiteness in the centre, and is terminated by two different series of colours at the different ends. These series are still divided by well-marked lines: on the one hand the red remains unmixed; the space belonging to the green and blue becomes a greenish yellow, nearly uniform throughout, and here the appearance of colour ends, the place of the violet being scarcely distinguishable from the neighbouring white light: on the other hand, the space belonging to the red, green, and blue of the simple spectrum, appears of a bluish green, becoming more and more blue till it meets the violet, which retains its place without alteration. This second series is also the same that accompanies the limit of total reflection at the posterior surface of a prism.

Sir Isaac Newton observed that the effect of white light on the sense of sight might be imitated by a mixture of colours taken from different parts



FRAUNHOFER LINES, dicovered by Wollaston and here described by Young, were at first thought to mark the divisions between the colors in the solar spectrum. Since Fraunhofer discovered their true significance, they have been the means of chemical analysis of glowing matter throughout space. The spectrum here shown (full size) was photographed recently at Mt. Wilson observatory with the largest spectrograph in the world, of 75-foot focus. The two heavy lines are the "double line" of sodium, with many faint lines between them, including the heavier one of nickel

Young On Color Vision—*Continued*

of the spectrum, notwithstanding the omission of some of the rays naturally belonging to white light. Thus, if we intercept one-half of each of the four principal portions into which the spectrum is divided, the remaining halves will still preserve, when mixed together, the appearance of whiteness; so that it is probable that the different parts of those portions of the spectrum, which appear of one colour, have precisely the same effect on the eye. It is certain that the perfect sensations of yellow and of blue are produced respectively, by mixtures of red and green and of green and violet light, and there is reason to suspect that those sensations are always compounded of the separate sensations combined; at least, this supposition simplifies the theory of colours: it may, therefore, be adopted with advantage, until it be found inconsistent with any of the phenomena; and we may consider white light as composed of a mixture of red, green, and violet only, in the proportion of about two parts red, four green, and one violet, with respect to the quantity or intensity of the sensations produced.

Mixtures of Colours

If we mix together, in proper proportions, any substances exhibiting these colours in their greatest purity, and place the mixture in a light sufficiently strong, we obtain the appearance of perfect whiteness; but in a fainter light the mixture is grey, or of that hue which arises from a combination of white and black; black bodies being such as reflect white light but in a very scanty proportion. For the same reason, green and red substances mixed together usually make rather a brown than a yellow colour, and many yellow colours, when laid on very thickly, or mixed with black, become brown. The sensations of various kinds of light may also be combined in a still more satisfactory manner, by painting the surface of a circle with different colours, in any way that may be desired, and causing it to revolve with such rapidity that the whole may assume the appearance of a single tint, or of a combination of tints, resulting from the mixture of the colours.

From three simple sensations, with their combinations, we obtain seven primitive distinctions of colours; but the different proportions in which they may be combined afford a variety of tints beyond all calculation. The three simple sensations being red, green, and violet, the three binary combinations are yellow, consisting of red and green; crimson, of red and violet; and blue, of green and violet; and the seventh in order is white light, composed by all the three united. But the blue thus produced, by combining the whole of the green and violet rays, is not the blue of the spectrum, for four parts of green and one of violet make a blue, differing very little from green; while the blue of the spectrum appears to contain as much violet as green: and it is for this reason that red and blue usually make a purple, deriving its hue from the predominance of the violet.

It would be possible to exhibit at once to the eye the combinations of any three colours in all imaginable varieties. Two of them might be laid down on a revolving surface, in the form of triangles, placed in opposite directions, and the third on projections perpendicular to the surface, which, while the eye remained at rest in any one point, obliquely situated, would exhibit more or less of their painted sides, as they passed through their different angular positions; and the only further alteration, that could be produced in any of the tints, would be derived from the different degrees of light only. The same effect may also be exhibited by mixing the colours in different proportions, by means of the pencil, beginning from three equidistant points as the centres of the respective colours. . . .

Rainbows and Halos

The atmospherical phenomena of rainbows and halos present us with examples of the spontaneous separation of colours by refraction. The rainbow is universally attributed to the refraction and reflection of the sun's rays in the minute drops of falling rain or dew, and the halos, usually appearing in frosty atmospheres, are in all probability produced by the refraction of small triangular or hexagonal crystals of snow. It is only necessary, for the formation of a rainbow, that the sun should shine on a dense cloud or a shower of rain, in a proper situation, or even on a number of minute drops of water, scattered by a brush or by a syringe, so that the light may reach the eye after having undergone a certain angular deviation, by means of various refractions and reflections; and the drops so situated must necessarily be found somewhere in a conical surface, of which the eye is the vertex, and must present the appearance of an arch. The light, which is reflected by the external surface of a sphere, is scattered almost equally in all directions, setting aside the difference arising from the greater efficacy of oblique reflection; but when it first enters the drop, and is there reflected by its posterior surface, its deviation never exceeds a certain angle, which depends on the degree of refrangibility, and is, therefore, different for light of different colours; and the density of the light being the greatest at the angle of greatest deviation, the appearance of a luminous arch is produced by the rays of each colour at its appropriate distance. The rays which never enter the drops produce no other effect than to cause a brightness or haziness round the sun, where the reflection is the most oblique; those which are once reflected within the drop exhibit the common internal or primary rainbow, at the distance of about 41 degrees from the point opposite to the sun; those which are twice reflected, the external or secondary rainbow, of 52°; and if the effect of the light, three times reflected, were sufficiently powerful, it would appear at the distance of about 42 degrees from the sun. The colours of both rainbows encroach considerably on each other; for each point of the sun may be considered as affording a distinct arch of each colour, and the whole disc as producing an arch about half a degree in breadth for each kind of light; so that the arrangement nearly resembles that of the common mixed spectrum.

Thomas Young was born in Somerset, England, June 13, 1773, and died in London, May 10, 1829. At the age of 14 he knew 7 languages, including Persian and Arabic. He began to study medicine in England at the age of 19, and took his doctor's degree at 23 from the University of Göttingen. Three years later he established a practice in London. The following year he was appointed professor at the Royal Institution, where he gave the course of lectures from which the above extract is taken. At the age of 29 he was appointed foreign secretary of the Royal Society of London. He had become a Fellow at the age of 21. In later years he served as secretary of committees on a variety of subjects, from the length of the seconds pendulum to the dangers of gas lighting in London. He was made a Foreign Associate of the French Academy of Sciences in 1827.

"Modern" Insects Like Heat

Entomology

The "flaming youth" of the insect world, evolutionally speaking, are just as fond of the bright lights, a hot time, and fast living generally as are their human prototypes. That is to say, the more "modern" insects, the species most recently evolved, have a higher metabolic rate, faster phsysiological processes, move more rapidly, and prefer bright sunlight and the warmer parts of the earth.

This is the thesis advanced by Dr. Clarence H. Kennedy of Ohio State University, writing in *Ecology*. He has made a special study of the dragonflies, but has examined also the family trees and present modes of living of a large number of other groups of insects, and in general he finds that they all fall into line with his theory.

"Modern" or recently evolved insects in general have three preferences. They like the tropics as a place to live, they prefer open, sunny places rather than dim woods or shelters under bark or stones, and, when they needs must live in a cooler zone they thrive best in the hot summer rather than in the cool spring. Insects of this group include such active and relatively intelligent orders as the ants and bees, the higher dragonflies and the day-flying butterflies.

The tastes of the old-fashioned insects, which have sometimes been called "surviving fossils", are just the opposite. They develop their maximum numbers in the cooler parts of the earth, fly in the cooler parts of the day or lurk in the shady woods or even in dark crevices, and are most active in the cooler seasons. These hexapod fogies include stoneflies and mayflies, thrips, booklice, and the lower families of the grasshopper, moth and fly orders.

Another point developed by Dr. Kennedy has to do with the length of life of the groups compared. The "slow" insects live long—breed only once a year as a rule, or sometimes require several years to come to maturity. He cites one primitive genus, an intermediate form between crickets and cockroaches, which takes three years to come to maturity, and which has to be raised on ice in a refrigerator. The "fast" moderns, on the other hand, mature and reproduce much more rapidly, a couple of weeks sufficing for the whole life cycle of some of the higher flies. Theirs seems to be a short life and a merry one.

Dr. Kennedy's study upsets the old fable of the ant and the grasshopper. For, while a few of the grasshopper order are modern and "fast", the bulk of the family is conservative; whereas none of the ants are "slow" and most of them belong very decidedly to the insect fast set.

Science News-Letter, December 15, 1928

Chickens Dislike Oats

Zoology

Dr. Samuel Johnson, the famous dictionary writer, is said to have had a low opinion of both oats and Scots. At any rate, he defined oats as "a grain that is fed to horses; but in Scotland is used for men."

It now appears that English chickens agree with the learned doctor, for they don't like oats. But, unlike Dr. Johnson, they do something toward backing up their opinions. Scientific tests conducted at the School of Agriculture at Cambridge have shown that fowls digest oats much less completely than they do wheat. The chief difficulty seems to be with the hulls, which horses apparently delight to chew, but which are apparently just so much unnecessary impediment to digestion in the gizzard of a chicken.

Science News-Letter, December 15, 1928

Electric Meter for Gas

Physics

No longer will aviators have to guess at their fuel supply when the gasoline gauge freezes or breaks. A simple and strongly constructed electric meter, connected by wires to the bottom of the gas tank, may tell the gas supply in future planes. The new gauge is the invention of J. H. Payne, of the General Electric Company. By means of a diaphragm at the bottom of the tank with a pile of small pieces of carbon back of it, the exact weight of the gasoline is measured. It will measure the amount of fuel in the tank to within an eighth of an inch, or about one per cent. of the amount.

Science News-Letter, December 15, 1928

A specialist states that the majority of men and women over 35 years of age have defective hearing in at least one ear.

NATURE RAMBLINGS

By FRANK THONE

Natural History

Ishmael

An outcast even among the creatures of the wilderness, furtive, cowardly except when desperately hungry, friend to none and befriended by none, the little wolf we call the coyote is an object at once of contempt and pity. He lacks the strength and the organization that make the big "lobos" terrible against stock and big game, and so for the most part is spared the relentless pursuit that has all but wiped his larger cousins off the range. But he is able, in small packs, to pull down calves and young elk, and causes some losses that way. But woe to him if a cow elk, or even a blacktail doe, catches him in an assault on her offspring. Against such as he horns are not needed, and the unantlered females of our deer tribe turn on him with their sharp front hooves, and often as not gash his ribs cruelly or perhaps even kill him outright.

Because of this the coyote does not atttack the young of game animals unless he catches them alone, or perhaps orphaned by the rigors of a hard winter. Aged and decrepit elk and deer, also, are sometimes spared the last agonies of starvation by the onslaught of a half-dozen coyotes. But for the most part, the coyote is a snapper-up of unconsidered trifles —rats and mice and such small deer— and a feeder on carrion, competing with buzzards and crows. As a traveling trap for ground squirrels, gophers, prairie dogs and other rodents, the coyote is a real servant of the community, and for this reason is tolerated in many sections where the appearance of even a single timber wolf would be the signal for a community hunt. Even Ishmael hath his uses.

Science News-Letter, December 15, 1928

CHRISTMAS BOOKS

As Christmastide approaches we search for appropriate remembrances. To your friends who are workers in the field of science and lovers of tales of science we submit the list below. Just check the ones desired. Each book sent postpaid anywhere in the United States.

AERONAUTICS

☐ Allen, Elmer L.—*Model Airplanes.* New York, 1928. Complete directions and diagrams. $3.50

☐ Colvin, Fred H., and Colvin, Henry F.—*The Aircraft Handbook.* New York, 1928. On the construction and care of planes and accessories. 4.00

☐ Fraser, Chelsea — *Heroes of the Air.* New York, 1928. From the beginning up to Lindbergh, Byrd and Miss Earhart. 2.00

☐ Hamburg, Merrill—*Beginning to Fly.* Boston, 1928. Another book on model airplanes. 2.50

☐ Holland, Rupert Sargent — *Historic Airships.* Philadelphia, 1928. With numerous illustrations in color and half-tone..... 4.00

☐ Jones, Paul—*An Alphabet of Aviation.* Philadelphia, 1928. The basic facts about aircraft, in picture and text. 2.00

ASTRONOMY

☐ Chamberlin, Thomas C.—*The Two Solar Famiiies.* Chicago, 1928. The first account of some important theories. $2.50

☐ Eddington, A. S.—*Stars and Atoms.* New Haven, 1927. A fascinating account of modern conceptions..... 2.00

☐ Ingalls, Albert G.—*Amateur Telescope Making.* New York, 1928. It isn't as hard as it might seem!.... 3.00

☐ Kenton, Edna—*The Book of Earths.* New York, 1928. Ancient and modern ideas of cosmography..... 6.00

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☐ Proctor, Mary—*The Romance of the Sun.* New York, 1927. ..... 2.50

Three delightful books by a well-known popular writer.

GEOLOGY

☐ Benson, Allan L.—*The Story of Geology.* New York, 1928. Profusely illustrated.$4.00

☐ Berry, Edward W.—*Tree Ancestors.* Baltimore, 1927. ..... 3.00

☐ Brewster, Edwin Tenny—*This Puzzling Planet.* Indianapolis, 1928..... 4.00

☐ Coleman, A. P.—*Ice Ages, Recent and Ancient.* New York, 1926..... 4.00

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☐ Mather, Kirtley F. — *Old Mother Earth.* Cambridge, 1928. ..... 2.50

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☐ Schubert, Paul—*The Electric Word: The Rise of Radio.* New York, 1928. Its economic as well as scientific phases. 2.50

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☐ Eddington, A. S.—*The Nature of the Physical World.* New York, 1928. Prof. Eddington's latest work..... 3.75

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